

THE IRONTON FIRE BRICK COMPANY

MANUFACTURERS OF
"RELIABLE REFRACTORIES"
FROM
HIGH GRADE
KENTUCKY FLINT CLAYS

Ironton, Ohio
1941





Catalog

CONTAINING VALUABLE INFORMATION

CONCERNING THE USE OF

Fireclay Brick

AS MANUFACTURED BY

The Ironton Fire Brick Co.
Ironton, Ohio

ISSUED OCTOBER, 1939

Approved by

AMERICAN REFRACTORIES INSTITUTE

with revisions to date

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The Ironton Fire Brick Co.

INCORPORATED

MANUFACTURERS OF HIGH GRADE
KENTUCKY QUALITY
REFRACTORIES

WORKS:

Ironton, Lawrence County, Ohio

MINES:

Bradmyer, Carter County, Ky.
(OLIVE HILL DISTRICT)

GENERAL OFFICES:

Ironton, Ohio

INTRODUCTION

In presenting this catalog to the trade we have endeavored to show only such shapes as are commonly used and have given such information in relation thereto as we believe will be of value.

It is our aim to keep in stock, at all times, an adequate supply of Standard Shapes, and while a large percentage of our output is special and difficult shapes, yet we do not always carry these in stock. However, we can deliver special designs in approximately four weeks' time.

Good material is a factor of supreme importance in all processes of manufacture. Especially is this true of fire brick. No matter how expert one may be in the manufacture of fire brick, or how modern the plant, unless ample quantities of high grade clays are available, no skill is sufficient to produce a high grade product.

We are fortunate in having a large acreage of very high grade flint and semi-flint clays, located in Carter County, Ky., in the very heart of the famous Olive Hill fireclay district. Exhaustive experiments and tests have shown this clay to be

of exceptional value; analyzing very high in alumina, and low in impurities, the following analyses and P. C. E. being typical.

	Flint	Semi-Flint
Ignition loss.....	13.30	13.72
Silica.....	43.64	44.84
Alumina.....	39.22	38.89
Iron Oxide.....	.96	1.35
Titania.....	1.48	not determined
Lime.....	.27	.52
Magnesia.....	.43	.40
Alkalies.....	.29	.53
P. C. E.	Cone 33	Cone 33

Our unlimited supply of these high grade clays, together with our modern methods of manufacture, guarantees to our customers a constant supply of high grade fire brick on which they can absolutely depend. Ample proof is given to this assertion by the ever increasing volume of our brick being used in cupolas, the chemical industry, the automotive industry, by-product coke ovens, open hearths, glass furnaces, lime kilns, boiler settings, malleable furnaces, heating furnaces, annealing ovens, incinerators, water gas machines, ceramic kilns, and in other uses where high grade refractories are necessary.

We invite you to make use of our Research and Engineering Departments. These services are for your benefit and are gratis.

GUARANTEES

No performance guarantee of any kind is made in the sale of refractories.

In the execution of orders for his products the manufacturer undertakes to furnish material which in his judgment is best suited for the purpose for which it is purchased.

Having thus met the full sense of the obligation to the industries he serves and having no control over the use of his product after it is placed in service, the manufacturer believes that there is a similar obligation on the part of the purchaser to seek and select the material which will give him the best results and to exercise extreme care and discretion in the use of the material which he receives.

SIZE DEVIATIONS

On dimensions of 4" or less—a maximum variation of 3% and a minimum variation of 2% are allowable.

On dimensions of over 4"—a maximum variation of 2% and a minimum variation of 1½% are allowable.

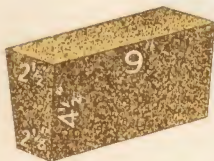
OVERSHIPMENTS

The following overages shall be allowable on all shipments of shapes that are not standard:

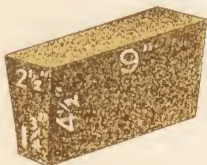
QUANTITY SPECIFIED	OVERAGES
1— 10	1 Shape*
11— 100	10%
101— 250	7%
251— 750	5%
751— 1500	4%
1501— 5000	3%
5001—10000	2%
Over 10000	1%

*If in sets, 1 complete set.

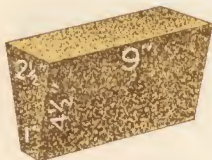
STANDARD 9 x 4½ x 2½-INCH SERIES



9" No. 1 Arch—2½" Series
 9" × 4½" × (2½" — 2⅛")



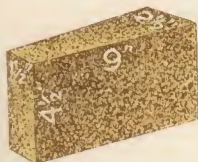
9" No. 2 Arch—2½" Series
 9" × 4½" × (2½" — 1¾")



9" No. 3 Arch—2½" Series
 9" × 4½" × (2½" — 1")

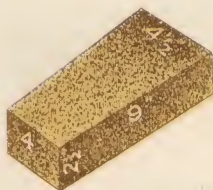


9" No. 1 Wedge—2½" Series
 9" × 4½" × (2½" — 1⅞")

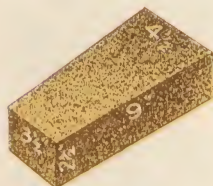


9" No. 2 Wedge—2½" Series
 9" × 4½" × (2½" — 1½")

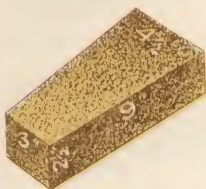
STANDARD 9 x 4½ x 2½-INCH SERIES



9" No. 1 Key—2½" Series
 $9" \times (4\frac{1}{2}" - 4") \times 2\frac{1}{2}"$



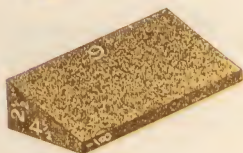
9" No. 2 Key—2½" Series
 $9" \times (4\frac{1}{2}" - 3\frac{1}{2}") \times 2\frac{1}{2}"$



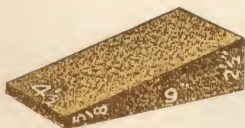
9" No. 3 Key—2½" Series
 $9" \times (4\frac{1}{2}" - 3") \times 2\frac{1}{2}"$



9" No. 4 Key—2½" Series
 $9" \times (4\frac{1}{2}" - 2\frac{1}{4}") \times 2\frac{1}{2}"$



9" Feather Edge—2½" Series
 $9" \times 4\frac{1}{2}" \times (2\frac{1}{2}" - \frac{1}{8}")$

STANDARD $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ -INCH SERIES

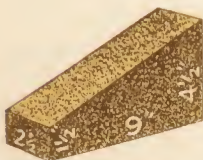
9" Neck Brick— $2\frac{1}{2}$ " Series
 $9" \times 4\frac{1}{2}" \times (2\frac{1}{2}" - \frac{5}{8}")$



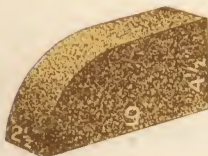
9" End Skew— $2\frac{1}{2}$ " Series
 $(9" - 6\frac{3}{4}") \times 4\frac{1}{2}" \times 2\frac{1}{2}"$



9" Side Skew— $2\frac{1}{2}$ " Series
 $9" \times (4\frac{1}{2}" - 2\frac{1}{4}") \times 2\frac{1}{2}"$

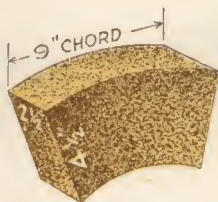


9" Edge Skew— $2\frac{1}{2}$ " Series
 $9" \times (4\frac{1}{2}" - 1\frac{1}{2}") \times 2\frac{1}{2}"$



9" Jamb Brick— $2\frac{1}{2}$ " Series
 $9" \times 4\frac{1}{2}" \times 2\frac{1}{2}"$

STANDARD 9 x 4½ x 2½-INCH SERIES



9" Circle Brick

Dimensions of all Circle Brick

Outside Chord.....	9 inches
Radial Dimension.....	4½ inches
Thickness.....	2½ inches

Brick number	Inside chord in inches	Diameter in inches		Number of brick to circle
		Inside	Outside	
24-33	6 ¹⁷ / ₃₂	24	33	12
36-45	7 ³ / ₁₆	36	45	16
48-57	7 ¹⁹ / ₃₂	48	57	20
60-69	7 ¹³ / ₁₆	60	69	24
72-81	8 °	72	81	29
84-93	8 ¹ / ₈	84	93	33
96-105	8 ⁷ / ₃₂	96	105	37
108-117	8 ³ / ₁₆	108	117	41
120-129	8 ³ / ₈	120	129	45

STANDARD 9 x 4½ x 3-INCH SERIES

Name of Brick	Dimensions
9" Straight—3" Series	9" × 4½" × 3"
Small 9" Brick—3" Series	9" × 3½" × 3"
9" Soap—3" Series	9" × 2¼" × 3"
9" Split Brick—3" Series	9" × 4½" × 1½"
9" No. 1 Arch—3" Series	9" × 4½" × (3"—2¾")
9" No. 2 Arch—3" Series	9" × 4½" × (3"—2½")
9" No. 3 Arch—3" Series	9" × 4½" × (3"—2")
9" No. 1 Wedge—3" Series	9" × 4½" × (3"—2¾")
9" No. 2 Wedge—3" Series	9" × 4½" × (3"—2½")
9" No. 3 Wedge—3" Series	9" × 4½" × (3"—2")
9" No. 1 Key—3" Series	9" × (4½"—4") × 3"
9" No. 2 Key—3" Series	9" × (4½"—3½") × 3"
9" No. 3 Key—3" Series	9" × (4½"—3") × 3"
9" No. 4 Key—3" Series	9" × (4½"—2¼") × 3"
9" Feather Edge—3" Series	9" × 4½" × (3"—⅛")
9" Neck Brick—3" Series	9" × 4½" × (3"—⅝")
9" End Skew—3" Series	(9"—6⅝") × 4½" × 3"
9" No. 1 Side Skew—3" Series	9" × (4½"—2⅛") × 3"
9" No. 2 Side Skew—3" Series	9" × (4½"—1⅜") × 3"

OTHER STANDARD SIZES



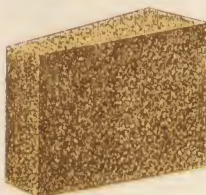
Large 9" Straight— $2\frac{1}{2}$ " Series
 $9" \times 6\frac{3}{4}" \times 2\frac{1}{2}"$

Large 9" Straight—3" Series
 $9" \times 6\frac{3}{4}" \times 3"$



Large 9" No. 1 Wedge— $2\frac{1}{2}$ " Series
 $9" \times 6\frac{3}{4}" \times (2\frac{1}{2}" - 1\frac{7}{8}")$

Large 9" No. 1 Wedge—3" Series
 $9" \times 6\frac{3}{4}" \times (3" - 2\frac{3}{4}")$



Large 9" No. 2 Wedge— $2\frac{1}{2}$ " Series
 $9" \times 6\frac{3}{4}" \times (2\frac{1}{2}" - 1\frac{1}{2}")$

Large 9" No. 2 Wedge—3" Series
 $9" \times 6\frac{3}{4}" \times (3" - 2\frac{1}{2}")$



Large 9" No. 3 Wedge
 $9" \times 6\frac{3}{4}" \times (3" - 2")$



Flat Back Straight
 $9" \times 6" \times 2\frac{1}{2}"$

Flat Back Split
 $9" \times 6" \times 1\frac{1}{4}"$

OTHER STANDARD SIZES

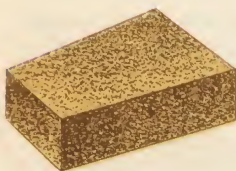


No. 1 Flat Back Arch
 $9'' \times 6'' \times (3\frac{1}{2}'' - 2\frac{1}{2}'')$

No. 2 Flat Back Arch
 $9'' \times 6'' \times (3\frac{1}{2}'' - 2'')$

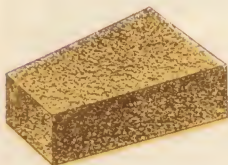


$9'' \times 6'' \times 2\frac{1}{2}''$ Straight
 $9'' \times 6'' \times 3''$ Straight



$9'' \times 6'' \times 2\frac{1}{2}''$ No. 1 Key
 $9'' \times (6'' - 5\frac{3}{8}'') \times 2\frac{1}{2}''$

$9'' \times 6'' \times 3''$ No. 1 Key
 $9'' \times (6'' - 5\frac{3}{8}'') \times 3''$



$9'' \times 6'' \times 2\frac{1}{2}''$ No. 2 Key
 $9'' \times (6'' - 4\frac{13}{16}'') \times 2\frac{1}{2}''$

$9'' \times 6'' \times 3''$ No. 2 Key
 $9'' \times (6'' - 4\frac{13}{16}'') \times 3''$

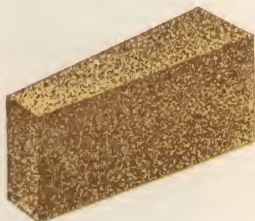
OTHER STANDARD SIZES



12"×6"×3" Straight

13½"×6"×2½" Straight

13½"×6"×3" Straight



12"×6"×3" No. 1 Wedge

12"×6"×(3"—2¾")

12"×6"×3" No. 2 Wedge

12"×6"×(3"—2½")

12"×6"×3" No. 3 Wedge

12"×6"×(3"—2")

13½"×6"×3" No. 1 Wedge

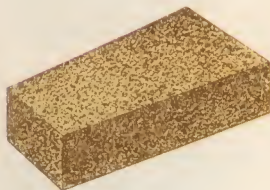
13½"×6"×(3"—2¾")

13½"×6"×3" No. 2 Wedge

13½"×6"×(3"—2½")

13½"×6"×3" No. 3 Wedge

13½"×6"×(3"—2")



13½"×6"×2½" No. 1 Key

13½"×(6"—5")×2½"

13½"×6"×3" No. 1 Key

13½"×(6"—5")×3"

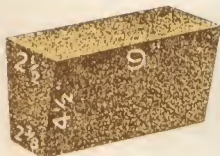
13½"×6"×2½" No. 2 Key

13½"×(6"—4⅜")×2½"

13½"×6"×3" No. 2 Key

13½"×(6"—4⅜")×3"

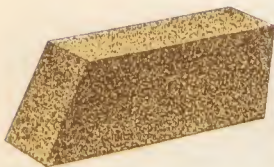
OTHER STANDARD SIZES



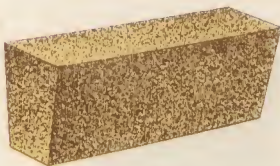
9" Bung Arch
 $9" \times 4\frac{1}{2}" \times (2\frac{1}{2}" - 2\frac{3}{8}")$



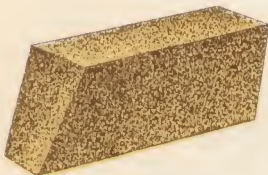
$13\frac{1}{2}"$ No. 101 Square Bung
 $13\frac{1}{2}" \times 4\frac{1}{2}" \times 3"$
 13" No. 101 Square Bung
 $13" \times 4\frac{1}{2}" \times 3"$
 9" No. 101 Square Bung
 $9" \times 4\frac{1}{2}" \times 3"$



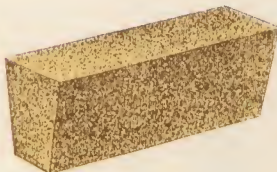
$13\frac{1}{2}"$ No. 102 Angle Bung
 $(13\frac{1}{2}" - 12\frac{1}{8}") \times 4\frac{1}{2}" \times 3"$
 13" No. 102 Angle Bung
 $(12\frac{3}{4}" - 11\frac{3}{8}") \times 4\frac{1}{2}" \times 3"$



$13\frac{1}{2}"$ No. 103 Bung Arch
 $13\frac{1}{2}" \times 4\frac{1}{2}" \times (3" - 2\frac{5}{8}")$
 13" No. 103 Bung Arch
 $13" \times 4\frac{1}{2}" \times (3" - 2\frac{5}{8}")$



$13\frac{1}{2}"$ No. 104 Arch Angle Bung
 $(13\frac{1}{2}" - 12\frac{1}{8}") \times 4\frac{1}{2}" \times (3" - 2\frac{5}{8}")$
 13" No. 104 Arch Angle Bung
 $(12\frac{3}{4}" - 11\frac{3}{8}") \times 4\frac{1}{2}" \times (3" - 2\frac{5}{8}")$

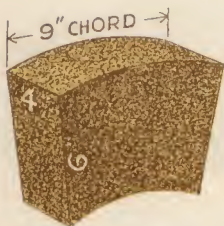


$13\frac{1}{2}"$ No. 105 Bung Arch
 $13\frac{1}{2}" \times 4\frac{1}{2}" \times (3" - 2\frac{7}{8}")$
 13" No. 105 Bung Arch
 $13" \times 4\frac{1}{2}" \times (3" - 2\frac{7}{8}")$
 9" No. 105 Bung Arch
 $9" \times 4\frac{1}{2}" \times (3" - 2\frac{7}{8}")$

OTHER STANDARD SIZES



Open Hearth Checker

 $9'' \times 6'' \times 3''$ $13\frac{1}{2}'' \times 4\frac{1}{2}'' \times 3''$ $10\frac{1}{2}'' \times 4\frac{1}{2}'' \times 3''$ $13\frac{1}{2}'' \times 4\frac{1}{2}'' \times 4\frac{1}{2}''$ $10\frac{1}{2}'' \times 4\frac{1}{2}'' \times 4\frac{1}{2}''$ $13\frac{1}{2}'' \times 6'' \times 2\frac{1}{2}''$ $13\frac{1}{2}'' \times 6'' \times 3''$ 6" Cupola Blocks and
6" Rotary Kiln Blocks

Dimensions of all Blocks

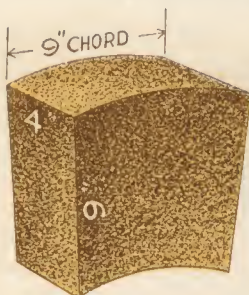
Outside Chord9 inches

Radial Dimension . . 6 inches

Thickness4 inches

Block number	Inside chord in inches	Diameter in inches		Number of blocks to circle
		Inside	Outside	
30-42	$6\frac{7}{16}$	30	42	15
36-48	$6\frac{3}{4}$	36	48	17
42-54	7	42	54	19
48-60	$7\frac{3}{16}$	48	60	21
54-66	$7\frac{5}{8}$	54	66	23
60-72	$7\frac{1}{2}$	60	72	26
66-78	$7\frac{5}{8}$	66	78	28
72-84	$7\frac{23}{32}$	72	84	30
78-90	$7\frac{13}{16}$	78	90	32
84-96	$7\frac{7}{8}$	84	96	34
90-102	$7\frac{15}{16}$	90	102	36
96-108	8	96	108	38
102-114	$8\frac{1}{16}$	102	114	40
108-120	$8\frac{3}{16}$	108	120	42
114-126	$8\frac{5}{16}$	114	126	44
120-132	$8\frac{3}{8}$	120	132	46
123-135	$8\frac{5}{16}$	123	135	48

OTHER STANDARD SIZES



9" Rotary Kiln Blocks

Dimensions of all Blocks

Outside Chord.....	9 inches
Radial Dimension.....	9 inches
Thickness.....	4 inches

Block number	Inside chord in inches	Diameter in inches		Number of blocks to circle
		Inside	Outside	
48-66	$6\frac{17}{32}$	48	66	23
54-72	$6\frac{3}{4}$	54	72	26
60-78	$6\frac{15}{16}$	60	78	28
66-84	$7\frac{1}{16}$	66	84	30
72-90	$7\frac{3}{16}$	72	90	32
78-96	$7\frac{5}{16}$	78	96	34
84-102	$7\frac{13}{32}$	84	102	36
90-108	$7\frac{1}{2}$	90	108	38
96-114	$7\frac{19}{32}$	96	114	40
102-120	$7\frac{21}{32}$	102	120	42
108-126	$7\frac{23}{32}$	108	126	44
114-132	$7\frac{25}{32}$	114	132	46
117-135	$7\frac{13}{16}$	117	135	48
120-138	$7\frac{15}{16}$	120	138	49
123-141	$7\frac{27}{32}$	123	141	50
126-144	$7\frac{7}{8}$	126	144	51
132-150	$7\frac{29}{32}$	132	150	53
138-156	$7\frac{31}{32}$	138	156	55
144-162	8	144	162	57
150-168	$8\frac{1}{32}$	150	168	59

OTHER STANDARD SIZES

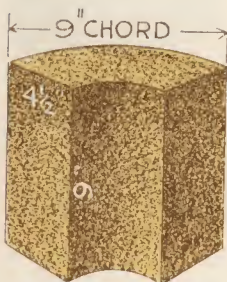


4 1/2" Cupola Blocks

Dimensions of all Blocks

Outside Chord....9 inches
 Radial Dimension 4 1/2 inches
 Height.....4 inches

Block number	Inside chord in inches	Diameter in inches		Number of blocks to circle
		Inside	Outside	
27-36	6 3/4	27	36	13
32-41	7 1/2	32	41	15



9" Cupola Blocks

Dimensions of all Blocks

Outside Chord....9 inches
 Radial Dimension 4 1/2 inches
 Height.....9 inches

Name of block	Inside chord in inches	Diameter in inches		Number of blocks to circle
		Inside	Outside	
A	5 3/4	16	25	9
B	6 5/16	21	30	11
C	6 3/4	27	36	13
D	6 13/16	30	39	14
E	7 11/32	40	49	18
F	7 21/32	51	60	21
G	7 13/16	60	69	24
H	8	73	82	29

9 x 4½ x 2½-INCH ARCH BRICK

Inside diameter	Number required to turn circle				
	No. 3 Arch	No. 2 Arch	No. 1 Arch	Straight	Total
0'—6"	19	..	..	...	19
1'—0"	12	15	..	...	27
1'—6"	4	30	..	...	34
1'—9"	..	38	..	...	38
2'—0"	..	34	8	...	42
2'—6"	..	26	23	...	49
3'—0"	..	19	38	...	57
3'—6"	..	11	53	...	64
4'—0"	..	4	68	...	72
4'—3"	76	...	76
4'—6"	76	4	80
5'—0"	76	11	87
5'—6"	76	19	95
6'—0"	76	26	102
6'—6"	76	34	110
7'—0"	76	41	117
7'—6"	76	49	125
8'—0"	76	56	132
8'—6"	76	64	140
9'—0"	76	71	147
9'—6"	76	79	155
10'—0"	76	87	163
10'—6"	76	94	170
11'—0"	76	102	178
11'—6"	76	109	185
12'—0"	76	117	193
12'—6"	76	124	200
13'—0"	76	132	208
13'—6"	76	139	215
14'—0"	76	147	223
14'—6"	76	154	230

9 x 4½ x 3-INCH ARCH BRICK

Inside diameter	Number required to turn circle				
	No. 3 Arch	No. 2 Arch	No. 1 Arch	Straight	Total
1'—6"	29	..	..	...	29
2'—0"	22	13	..	...	35
2'—6"	16	25	..	...	41
3'—0"	10	38	..	...	48
3'—6"	3	51	..	...	54
3'—9"	..	57	..	...	57
4'—0"	..	54	6	...	60
4'—6"	..	47	19	...	66
5'—0"	..	41	32	...	73
5'—6"	..	35	44	...	79
6'—0"	..	28	57	...	85
6'—6"	..	22	70	...	92
7'—0"	..	16	82	...	98
7'—6"	..	10	94	...	104
8'—0"	..	3	107	...	110
8'—3"	..	..	113	...	113
8'—6"	..	..	113	4	117
9'—0"	..	..	113	10	123

(Continued on next page)

9 x 4½ x 3-INCH ARCH BRICK (Concluded)

Inside diameter	Number required to turn circle				
	No. 3 Arch	No. 2 Arch	No. 1 Arch	Straight	Total
9'—6"	113	16	129
10'—0"	113	22	135
10'—6"	113	29	142
11'—0"	113	35	148
11'—6"	113	41	154
12'—0"	113	48	161
12'—6"	113	54	167
13'—0"	113	60	173
13'—6"	113	66	179
14'—0"	113	73	186
14'—6"	113	79	192

***9 x 4½ x 2½-INCH WEDGE BRICK**

Inside diameter	Number required to turn circle			
	No. 2 Wedge	No. 1 Wedge	Straight	Total
2'—3"	57	..	...	57
2'—6"	51	10	...	61
3'—0"	38	30	...	68
3'—6"	25	51	...	76
4'—0"	13	70	...	83
4'—6"	..	91	...	91
5'—0"	..	91	7	98
5'—6"	..	91	15	106
6'—0"	..	91	22	113
6'—6"	..	91	30	121
7'—0"	..	91	38	129
7'—6"	..	91	45	136
8'—0"	..	91	53	144
8'—6"	..	91	60	151
9'—0"	..	91	68	159
9'—6"	..	91	75	166
10'—0"	..	91	83	174
10'—6"	..	91	90	181
11'—0"	..	91	98	189
11'—6"	..	91	105	196
12'—0"	..	91	113	204
12'—6"	..	91	121	212
13'—0"	..	91	128	219
13'—6"	..	91	136	227
14'—0"	..	91	143	234
14'—6"	..	91	151	242
15'—0"	..	91	158	249
15'—6"	..	91	166	257
16'—0"	..	91	173	264
16'—6"	..	91	181	272
17'—0"	..	91	188	279
17'—6"	..	91	196	287
18'—0"	..	91	203	294
18'—6"	..	91	211	302
19'—0"	..	91	219	310
19'—6"	..	91	226	317

*Applies also to 9x6¾x2½-inch Wedges and Straights.

(Continued on next page)

***9 x 4½ x 2½-INCH WEDGE BRICK (Concluded)**

Inside diameter	Number required to turn circle			
	No. 2 Wedge	No. 1 Wedge	Straight	Total
20'—0"	..	91	234	325
20'—6"	..	91	241	332
21'—0"	..	91	249	340
21'—6"	..	91	256	347
22'—0"	..	91	264	355
22'—6"	..	91	271	362
23'—0"	..	91	279	370
23'—6"	..	91	286	377
24'—0"	..	91	294	385
24'—6"	..	91	301	392
25'—0"	..	91	309	400
25'—6"	..	91	317	408
26'—0"	..	91	324	415
26'—6"	..	91	332	423
27'—0"	..	91	339	430
27'—6"	..	91	347	438

*Applies also to 9x6¼x2½-inch Wedges and Straights.

***9 x 4½ x 3-INCH WEDGE BRICK**

Inside diameter	Number required to turn circle				
	No. 3 Wedge	No. 2 Wedge	No. 1 Wedge	Straight	Total
3'—0"	57	...	...	..	57
3'—6"	50	13	...	..	63
4'—0"	44	26	...	..	70
4'—6"	38	38	...	..	76
5'—0"	32	50	...	..	82
5'—6"	25	63	...	..	88
6'—0"	19	76	...	..	95
6'—6"	13	88	...	..	101
7'—0"	6	101	...	..	107
7'—6"	..	113	...	..	113
8'—0"	..	107	13	..	120
8'—6"	..	101	25	..	126
9'—0"	..	94	38	..	132
9'—6"	..	88	51	..	139
10'—0"	..	82	63	..	145
10'—6"	..	76	75	..	151
11'—0"	..	69	88	..	157
11'—6"	..	63	101	..	164
12'—0"	..	57	113	..	170
12'—6"	..	50	126	..	176
13'—0"	..	44	139	..	183
13'—6"	..	38	151	..	189
14'—0"	..	32	163	..	195
14'—6"	..	25	176	..	201
15'—0"	..	19	189	..	208
15'—6"	..	13	201	..	214
16'—0"	..	6	214	..	220
16'—6"	..	...	226	..	226
17'—0"	..	...	226	7	233
17'—6"	..	...	226	13	239

*Applies also to 9x6¼x3-inch Wedges and Straights.

(Continued on next page)

***9 x 4½ x 3-INCH WEDGE BRICK (Concluded)**

Inside diameter	Number required to turn circle				
	No. 3 Wedge	No. 2 Wedge	No. 1 Wedge	Straight	Total
18'—0"	226	19	245
18'—6"	226	26	252
19'—0"	226	32	258
19'—6"	226	38	264
20'—0"	226	45	271
20'—6"	226	51	277
21'—0"	226	57	283
21'—6"	226	63	289
22'—0"	226	70	296
22'—6"	226	76	302
23'—0"	226	82	308
23'—6"	226	89	315
24'—0"	226	95	321
24'—6"	226	101	327
25'—0"	226	107	333
25'—6"	226	114	340
26'—0"	226	120	346
26'—6"	226	126	352
27'—0"	226	133	359
27'—6"	226	139	365

*Applies also to 9x6¼x3-inch Wedges and Straights.

***9 x 4½ x 2½-INCH KEY BRICK**

Inside diameter	Number required to turn circle					
	No. 4 Key	No. 3 Key	No. 2 Key	No. 1 Key	Straight	Total
1'—6"	26	..	..	..	..	26
2'—0"	17	13	..	..	..	30
2'—6"	9	25	..	..	..	34
3'—0"	..	38	..	..	..	38
3'—6"	..	29	13	..	..	42
4'—0"	..	21	25	..	..	46
4'—6"	..	13	38	..	..	51
5'—0"	..	4	51	..	..	55
5'—3"	57	..	..	57
5'—6"	55	4	..	59
6'—0"	50	13	..	63
6'—6"	46	21	..	67
7'—0"	42	30	..	72
7'—6"	38	38	..	76
8'—0"	34	46	..	80
8'—6"	29	55	..	84
9'—0"	25	63	..	88
9'—6"	21	72	..	93

*Applies also to 9x4½x3-inch Key brick.

(Continued on next page)

***9 x 4½ x 2½-INCH KEY BRICK (Concluded)**

Inside diameter	Number required to turn circle					
	No. 4 Key	No. 3 Key	No. 2 Key	No. 1 Key	Straight	Total
10'—0"	17	80	...	97
10'—6"	13	88	...	101
11'—0"	9	96	...	105
11'—6"	4	105	...	109
12'—0"	113	...	113
12'—6"	113	5	118
13'—0"	113	9	122
13'—6"	113	13	126
14'—0"	113	17	130
14'—6"	113	21	134
15'—0"	113	26	139
15'—6"	113	30	143
16'—0"	113	34	147
16'—6"	113	38	151
17'—0"	113	42	155
17'—6"	113	47	160
18'—0"	113	51	164
18'—6"	113	55	168
19'—0"	113	59	172
19'—6"	113	63	176
20'—0"	113	68	181
20'—6"	113	72	185
21'—0"	113	76	189
21'—6"	113	80	193
22'—0"	113	84	197
22'—6"	113	88	201
23'—0"	113	93	206
23'—6"	113	97	210
24'—0"	113	101	214
24'—6"	113	105	218
25'—0"	113	109	222
25'—6"	113	114	227
26'—0"	113	118	231
26'—6"	113	122	235
27'—0"	113	126	239
27'—6"	113	130	243
28'—0"	113	135	248
28'—6"	113	139	252
29'—0"	113	143	256
29'—6"	113	147	260
30'—0"	113	151	264
30'—6"	113	155	268
31'—0"	113	160	273
31'—6"	113	164	277
32'—0"	113	168	281
32'—6"	113	172	285
33'—0"	113	176	289
33'—6"	113	181	294
34'—0"	113	185	298
34'—6"	113	189	302
35'—0"	113	193	306

*Applies also to 9x4½x3-inch Key brick.

***9 x 6 x 3-INCH KEY BRICK**

Inside diameter	Number required to turn circle			
	No. 2 Key	No. 1 Key	Straight	Total
6'—0"	48	..	..	48
6'—6"	45	6	..	51
7'—0"	41	13	..	54
7'—6"	38	19	..	57
8'—0"	34	26	..	60
8'—6"	31	32	..	63
9'—0"	27	39	..	66
9'—6"	24	46	..	70
10'—0"	21	52	..	73
10'—6"	17	59	..	76
11'—0"	13	66	..	79
11'—6"	10	72	..	82
12'—0"	6	79	..	85
12'—6"	3	85	..	88
13'—0"	..	91	..	91
13'—6"	..	91	4	95
14'—0"	..	91	7	98
14'—6"	..	91	10	101
15'—0"	..	91	13	104
15'—6"	..	91	16	107
16'—0"	..	91	19	110
16'—6"	..	91	22	113
17'—0"	..	91	26	117
17'—6"	..	91	29	120
18'—0"	..	91	32	123
18'—6"	..	91	35	126
19'—0"	..	91	38	129
19'—6"	..	91	41	132
20'—0"	..	91	44	135
20'—6"	..	91	48	139
21'—0"	..	91	51	142
21'—6"	..	91	54	145
22'—0"	..	91	57	148
22'—6"	..	91	60	151
23'—0"	..	91	63	154
23'—6"	..	91	66	157
24'—0"	..	91	70	161
24'—6"	..	91	73	164
25'—0"	..	91	76	167
25'—6"	..	91	79	170
26'—0"	..	91	82	173
26'—6"	..	91	85	176
27'—0"	..	91	88	179
27'—6"	..	91	92	183
28'—0"	..	91	95	186
28'—6"	..	91	98	189
29'—0"	..	91	101	192
29'—6"	..	91	104	195
30'—0"	..	91	107	198

*Applies also to 9X6X2½-inch Keys and Straights.

***13½ x 6 x 3-INCH KEY BRICK**

Inside diameter	Number required to turn circle			
	No. 2 Key	No. 1 Key	Straight	Total
6'—0"	52	..	..	52
6'—6"	48	7	..	55
7'—0"	43	16	..	59
7'—6"	38	24	..	62
8'—0"	33	32	..	65
8'—6"	28	40	..	68
9'—0"	23	48	..	71
9'—6"	18	56	..	74
10'—0"	13	64	..	77
10'—6"	8	73	..	81
11'—0"	3	81	..	84
11'—3"	..	85	..	85
11'—6"	..	85	2	87
12'—0"	..	85	5	90
12'—6"	..	85	8	93
13'—0"	..	85	11	96
13'—6"	..	85	14	99
14'—0"	..	85	18	103
14'—6"	..	85	21	106
15'—0"	..	85	24	109
15'—6"	..	85	27	112
16'—0"	..	85	30	115
16'—6"	..	85	33	118
17'—0"	..	85	36	121
17'—6"	..	85	39	124
18'—0"	..	85	43	128
18'—6"	..	85	46	131
19'—0"	..	85	49	134
19'—6"	..	85	52	137
20'—0"	..	85	55	140
20'—6"	..	85	58	143
21'—0"	..	85	61	146
21'—6"	..	85	65	150
22'—0"	..	85	68	153
22'—6"	..	85	71	156
23'—0"	..	85	74	159
23'—6"	..	85	77	162
24'—0"	..	85	80	165
24'—6"	..	85	83	168
25'—0"	..	85	87	172
25'—6"	..	85	90	175
26'—0"	..	85	93	178
26'—6"	..	85	96	181
27'—0"	..	85	99	184
27'—6"	..	85	102	187
28'—0"	..	85	105	190
28'—6"	..	85	109	194
29'—0"	..	85	112	197
29'—6"	..	85	115	200

*Applies also to 13½x6x2½-inch Keys and Straights.

(Continued on next page)

***13½ x 6 x 3-INCH KEY BRICK (Concluded)**

Inside diameter	Number required to turn circle			
	No. 2 Key	No. 1 Key	Straight	Total
30'—0"	..	85	118	203
30'—6"	..	85	121	206
31'—0"	..	85	124	209
31'—6"	..	85	127	212
32'—0"	..	85	131	216
32'—6"	..	85	134	219
33'—0"	..	85	137	222
33'—6"	..	85	140	225
34'—0"	..	85	143	228
34'—6"	..	85	146	231
35'—0"	..	85	149	234

*Applies also to 13½x6x2½-inch Keys and Straights.

FLAT BACK ARCH BRICK

Inside diameter	Number required to turn circle			
	No. 2 F.B.A.	No. 1 F.B.A.	F.B. St.	Total
1'—4"	26	..	...	26
1'—6"	22	5	...	27
1'—9"	16	14	...	30
2'—0"	11	22	...	33
2'—3"	5	30	...	35
2'—6"	..	38	...	38
3'—0"	..	38	8	46
3'—6"	..	38	15	53
4'—0"	..	38	23	61
4'—6"	..	38	30	68
5'—0"	..	38	38	76
5'—6"	..	38	45	83
6'—0"	..	38	53	91
6'—6"	..	38	60	98
7'—0"	..	38	68	106
7'—6"	..	38	75	113
8'—0"	..	38	83	121
8'—6"	..	38	91	129
9'—0"	..	38	98	136
9'—6"	..	38	106	144
10'—0"	..	38	113	151
10'—6"	..	38	121	159
11'—0"	..	38	128	166
11'—6"	..	38	136	174
12'—0"	..	38	143	181
12'—6"	..	38	151	189
13'—0"	..	38	158	196

12 x 6 x 3-INCH WEDGE BRICK

Inside diameter	Number required to turn circle				
	No. 3 Wedge	No. 2 Wedge	No. 1 Wedge	Straight	Total
4'—0"	76	...	...	..	76
4'—6"	69	13	...	..	82
5'—0"	63	25	...	..	88
5'—6"	57	38	...	..	95
6'—0"	51	50	...	..	101
6'—6"	44	63	...	..	107
7'—0"	38	75	...	..	113
7'—6"	32	88	...	..	120
8'—0"	25	101	...	..	126
8'—6"	19	113	...	..	132
9'—0"	13	126	...	..	139
9'—6"	7	138	...	..	145
10'—0"	..	151	...	..	151
10'—6"	..	144	13	..	157
11'—0"	..	139	25	..	164
11'—6"	..	132	38	..	170
12'—0"	..	126	50	..	176
12'—6"	..	120	63	..	183
13'—0"	..	113	76	..	189
13'—6"	..	107	88	..	195
14'—0"	..	101	100	..	201
14'—6"	..	95	113	..	208
15'—0"	..	88	126	..	214
15'—6"	..	82	138	..	220
16'—0"	..	76	151	..	227
16'—6"	..	69	164	..	233
17'—0"	..	63	176	..	239
17'—6"	..	57	188	..	245
18'—0"	..	51	201	..	252
18'—6"	..	44	214	..	258
19'—0"	..	38	226	..	264
19'—6"	..	32	239	..	271
20'—0"	..	25	252	..	277
20'—6"	..	19	264	..	283
21'—0"	..	13	276	..	289
21'—6"	..	7	289	..	296
22'—0"	..	...	302	..	302
22'—6"	..	...	302	6	308
23'—0"	..	...	302	13	315
23'—6"	..	...	302	19	321
24'—0"	..	...	302	25	327
24'—6"	..	...	302	31	333
25'—0"	..	...	302	38	340
25'—6"	..	...	302	44	346
26'—0"	..	...	302	50	352
26'—6"	..	...	302	57	359
27'—0"	..	...	302	63	365
27'—6"	..	...	302	69	371
28'—0"	..	...	302	75	377

13½ x 6 x 3-INCH WEDGE BRICK

Inside diameter	Number required to turn circle				
	No. 3 Wedge	No. 2 Wedge	No. 1 Wedge	Straight	Total
4'—6"	85	...	...	..	85
5'—0"	79	13	...	..	92
5'—6"	73	25	...	..	98
6'—0"	66	38	...	..	104
6'—6"	60	50	...	..	110
7'—0"	54	63	...	..	117
7'—6"	47	76	...	..	123
8'—0"	41	88	...	..	129
8'—6"	35	100	...	..	135
9'—0"	29	113	...	..	142
9'—6"	22	126	...	..	148
10'—0"	16	138	...	..	154
10'—6"	10	151	...	..	161
11'—0"	3	164	...	..	167
11'—3"	..	170	...	..	170
11'—6"	..	167	6	..	173
12'—0"	..	160	19	..	179
12'—6"	..	154	32	..	186
13'—0"	..	148	44	..	192
13'—6"	..	141	57	..	198
14'—0"	..	135	70	..	205
14'—6"	..	129	82	..	211
15'—0"	..	123	94	..	217
15'—6"	..	116	107	..	223
16'—0"	..	110	120	..	230
16'—6"	..	104	132	..	236
17'—0"	..	97	145	..	242
17'—6"	..	92	157	..	249
18'—0"	..	85	170	..	255
18'—6"	..	79	182	..	261
19'—0"	..	72	195	..	267
19'—6"	..	66	208	..	274
20'—0"	..	60	220	..	280
20'—6"	..	53	233	..	286
21'—0"	..	48	245	..	293
21'—6"	..	41	258	..	299
22'—0"	..	35	270	..	305
22'—6"	..	28	283	..	311
23'—0"	..	22	296	..	318
23'—6"	..	16	308	..	324
24'—0"	..	9	321	..	330
24'—6"	..	4	333	..	337
24'—9"	..	...	340	..	340
25'—0"	..	...	340	3	343
25'—6"	..	...	340	9	349

(Continued on next page)

13½ x 6 x 3-INCH WEDGE BRICK (Concluded)

Inside diameter	Number required to turn circle				
	No. 3 Wedge	No. 2 Wedge	No. 1 Wedge	Straight	Total
26'—0"	340	15	355
26'—6"	340	22	362
27'—0"	340	28	368
27'—6"	340	34	374
28'—0"	340	41	381
28'—6"	340	47	387
29'—0"	340	53	393
29'—6"	340	59	399
30'—0"	340	66	406
30'—6"	340	72	412
31'—0"	340	78	418
31'—6"	340	85	425
32'—0"	340	91	431
32'—6"	340	97	437
33'—0"	340	103	443
33'—6"	340	110	450
34'—0"	340	116	456
34'—6"	340	122	462
35'—0"	340	128	468
35'—6"	340	135	475
36'—0"	340	141	481
36'—6"	340	147	487
37'—0"	340	154	494
37'—6"	340	160	500
38'—0"	340	166	506
38'—6"	340	172	512
39'—0"	340	179	519
39'—6"	340	185	525
40'—0"	340	191	531
40'—6"	340	198	538
41'—0"	340	204	544
41'—6"	340	210	550
42'—0"	340	216	556
42'—6"	340	223	563
43'—0"	340	229	569
43'—6"	340	235	575
44'—0"	340	242	582
44'—6"	340	248	588
45'—0"	340	254	594
45'—6"	340	260	600
46'—0"	340	267	607
46'—6"	340	273	613
47'—0"	340	279	619
47'—6"	340	286	626
48'—0"	340	292	632

9-INCH CIRCLE BRICK

Inside diameter	Number required to turn circle					
	24-33	36-45	48-57	60-69	72-81	Total
2'-0"	12	..	..	..	..	12
2'-3"	9	4	..	..	..	13
2'-6"	6	8	..	..	..	14
2'-9"	3	12	..	..	..	15
3'-0"	..	16	..	..	..	16
3'-3"	..	12	5	..	..	17
3'-6"	..	8	10	..	..	18
3'-9"	..	4	15	..	..	19
4'-0"	..	..	20	..	..	20
4'-3"	..	..	16	5	..	21
4'-6"	..	..	10	12	..	22
4'-9"	..	..	4	19	..	23
5'-0"	..	..	..	24	..	24
5'-3"	..	..	..	17	9	26
5'-6"	..	..	..	12	15	27
5'-9"	..	..	..	6	22	28
6'-0"	..	..	..	..	29	29
	72-81	84-93	96-105	108-117	120-129	
6'-3"	21	9	..	..	..	30
6'-6"	14	17	..	..	..	31
6'-9"	7	25	..	..	..	32
7'-0"	..	33	..	..	..	33
7'-3"	..	23	11	..	..	34
7'-6"	..	14	21	..	..	35
7'-9"	..	5	31	..	..	36
8'-0"	..	..	37	..	..	37
8'-3"	..	..	25	13	..	38
8'-6"	..	..	18	21	..	39
8'-9"	..	..	10	30	..	40
9'-0"	..	..	..	41	..	41
9'-3"	..	..	..	34	8	42
9'-6"	..	..	..	23	20	43
9'-9"	..	..	..	13	31	44
10'-0"	..	..	..	..	45	45

9-INCH CUPOLA BLOCKS

Inside diameter	Number required to turn circle								Total
	A	B	C	D	E	F	G	H	
1'-4"	9	..	..	..	..	..	..	..	9
1'-6"	6	4	..	..	..	..	..	..	10
1'-9"	..	11	..	..	..	..	..	..	11
2'-0"	..	6	6	..	..	..	..	..	12
2'-3"	13	..	..	..	..	..	13
2'-6"	14	..	..	..	..	14
3'-0"	6	10	..	..	..	16
3'-4"	18	..	..	..	18
3'-6"	14	4	..	..	18
4'-0"	5	15	..	..	20
4'-3"	21	..	..	21
4'-6"	14	8	..	22
5'-0"	24	..	24
5'-6"	12	15	27
6'-0"	29	29
6'-1"	29	29

Note: Fractional parts of one tenth of a brick or more are counted as entire brick; smaller fractions are disregarded.

6-INCH CUPOLA BLOCKS AND 6-INCH ROTARY KILN BLOCKS

Inside diameter	Number required to turn circle							Total
	30-42	36-48	42-54	48-60	54-66	60-72	66-78	
2'-6"	15	..	..	..	..	..	..	15
2'-9"	8	8	..	..	..	..	..	16
3'-0"	..	17	..	..	..	..	..	17
3'-3"	..	8	10	..	..	..	..	18
3'-6"	19	..	..	..	..	19
3'-9"	9	11	..	..	..	20
4'-0"	21	..	..	..	21
4'-3"	10	12	..	..	22
4'-6"	23	..	..	23
4'-9"	13	11	..	24
5'-0"	26	..	26
5'-3"	14	13	27
5'-6"	28	28

Inside diameter	Number required to turn circle							Total
	60-72	66-78	72-84	78-90	84-96	90-102	96-108	
5'-9"	..	16	13	..	..	..	..	29
6'-0"	30	..	..	..	..	30
6'-3"	18	13	..	..	..	31
6'-6"	32	..	..	..	32
6'-9"	19	14	..	..	33
7'-0"	34	..	..	34
7'-3"	16	19	..	35
7'-6"	36	..	36
7'-9"	17	20	37
8'-0"	38	38

Inside diameter	Number required to turn circle							Total
	90-102	96-108	102-114	108-120	114-126	120-132	123-135	
8'-3"	..	22	17	..	..	..	..	39
8'-6"	40	..	..	..	..	40
8'-9"	22	19	..	..	..	41
9'-0"	42	..	..	..	42
9'-3"	24	19	..	..	43
9'-6"	44	..	..	44
9'-9"	36	9	..	45
10'-0"	46	..	46
10'-3"	48	48

Note: Fractional parts of one tenth of a brick or more are counted as entire brick; smaller fractions are disregarded.

9-INCH ROTARY KILN BLOCKS

Inside diameter	Number required to turn circle						Total
	48-66	54-72	60-78	66-84	72-90	78-96	
4'-0"	23	..	..	..	..	..	23
4'-3"	11	13	..	..	..	..	24
4'-6"	..	26	..	..	..	..	26
4'-9"	..	14	13	..	..	..	27
5'-0"	28	..	..	..	28
5'-3"	15	14	..	..	29
5'-6"	30	..	..	30
5'-9"	12	19	..	31
6'-0"	32	..	32
6'-3"	14	19	33

Inside diameter	Number required to turn circle						Total
	72-90	78-96	84-102	90-108	96-114	102-120	
6'-6"	..	34	..	..	..	..	34
6'-9"	..	16	19	..	..	..	35
7'-0"	36	..	..	..	36
7'-3"	17	20	..	..	37
7'-6"	38	..	..	38
7'-9"	22	17	..	39
8'-0"	40	..	40
8'-3"	27	14	41
8'-6"	42	42

Inside diameter	Number required to turn circle						Total
	102-120	108-126	114-132	117-135	120-138	123-141	
8'-9"	25	18	..	..	..	..	43
9'-0"	..	44	..	..	..	..	44
9'-3"	..	27	18	..	..	..	45
9'-6"	46	..	..	..	46
9'-9"	48	..	..	48
10'-0"	49	..	49
10'-3"	50	50

Inside diameter	Number required to turn circle						Total
	123-141	126-144	132-150	138-156	144-162	150-168	
10'-6"	..	51	..	..	..	..	51
10'-9"	..	14	38	..	..	..	52
11'-0"	53	..	..	..	53
11'-3"	24	30	..	..	54
11'-6"	55	..	..	55
11'-9"	34	22	..	56
12'-0"	57	..	57
12'-3"	24	34	58
12'-6"	59	59

Note: Fractional parts of one tenth of a brick or more are counted as entire brick; smaller fractions are disregarded.

TABLES OF MENSURATION

To find the circumference of a circle:

Multiply the diameter by 3.1416; or for approximate purposes by $3\frac{1}{4}$.

To find diameter of a circle when the circumference is given:

Divide the circumference by 3.1416; or for approximate purposes multiply the circumference by 7 and divide by 22.

To find the area of a circle:

Multiply the square of the radius by 3.1416.

To find the area of a triangle:

Multiply the base by one-half the perpendicular height.

To find the volume of a cylinder:

Multiply the area of the section by the length.

To find the volume of a sphere:

Multiply the cube of the diameter by .5236.

To find the volume of a cone or pyramid:

Multiply the area of the base by $\frac{1}{3}$ of the height.

To find the approximate weight of a brick or special shape in pounds:

Multiply the volume in cubic inches by .075.

To find the radius of an arch, when the span and rise are given:

Square the span or chord; divide by 8 times the rise and add $\frac{1}{2}$ the rise.

$$\frac{\text{Span}^2}{8 \times \text{Rise}} + \frac{\text{Rise}}{2} = \text{Radius}$$

To find the rise of an arch, when the span and radius are given:

Square the radius, also square $\frac{1}{2}$ the span; subtract the latter from the former, take the square root of the remainder, and subtract the result from the radius.

$$\text{Radius} - \sqrt{\text{Radius}^2 - \frac{1}{2} \text{Span}^2} = \text{Rise}$$

To change degrees Centigrade to Fahrenheit:

Multiply by 9, divide by 5 and add 32.

To change degrees Fahrenheit to Centigrade:

Subtract 32, divide by 9 and multiply by 5.

TABLE FOR USE IN DESIGNING SPECIAL RADIAL TYPE BRICK

For any given diameter and any arbitrarily selected chord, the approximate number of brick required to turn the circle is

$$\frac{\pi \times \text{diameter}}{\text{chord}} = \frac{\text{circumference}}{\text{chord}}$$

The nearest whole number above or below the calculated approximate number may be chosen.

When a chord of approximately 9 inches is desired, the number can be quickly determined by reference to the third column of the table. The given diameter will usually lie between two values in the table.

In either case,

$$\text{The Actual Chord} = \text{Diameter} \times \text{"Sine of Half Angle"}$$

Number of brick to circle	Sine of half angle	Diameter for 9" chord in inches	Number of brick to circle	Sine of half angle	Diameter for 9" chord in inches
5	.58779	15.312	26	.12054	74.664
6	.50000	18.000	27	.11609	77.526
7	.43388	20.743	28	.11197	80.379
8	.38268	23.518	29	.10812	83.241
9	.34202	26.314	30	.10453	86.100
10	.30902	29.124	31	.10117	88.959
11	.28173	31.945	32	.09802	91.818
12	.25882	34.773	33	.09506	94.677
13	.23932	37.607	34	.09227	97.540
14	.22252	40.446	35	.08964	100.402
15	.20791	43.288	36	.08716	103.258
16	.19509	46.133	37	.08481	106.120
17	.18375	48.980	38	.08258	108.985
18	.17365	51.828	39	.08047	111.843
19	.16459	54.681	40	.07846	114.708
20	.15643	57.534	41	.07655	117.570
21	.14904	60.386	42	.07473	120.434
22	.14231	63.242	43	.07299	123.305
23	.13616	66.099	44	.07134	126.156
24	.13053	68.950	45	.06976	129.014
25	.12533	71.810	46	.06825	131.868

**TABLE FOR USE IN DESIGNING SPECIAL
RADIAL TYPE BRICK
(Concluded)**

Number of brick to circle	Sine of half angle	Diameter for 9" chord in inches	Number of brick to circle	Sine of half angle	Diameter for 9" chord in inches
47	.06680	134.731	74	.04244	212.064
48	.06540	137.615	75	.04188	214.900
49	.06407	140.471	76	.04132	217.812
50	.06279	143.335	77	.04079	220.642
51	.06156	146.199	78	.04027	223.491
52	.06038	149.056	79	.03975	226.415
53	.05924	151.924	80	.03926	229.241
54	.05815	154.772	81	.03878	232.078
55	.05709	157.646	82	.03830	234.987
56	.05607	160.514	83	.03784	237.844
57	.05508	163.399	84	.03739	240.706
58	.05414	166.236	85	.03695	243.572
59	.05322	169.109	86	.03652	246.440
60	.05234	171.953	87	.03610	249.307
61	.05147	174.859	88	.03569	252.171
62	.05065	177.690	89	.03529	255.030
63	.04985	180.542	90	.03490	257.880
64	.04907	183.411	91	.03452	260.718
65	.04832	186.258	92	.03414	263.620
66	.04758	189.155	93	.03377	266.509
67	.04687	192.020	94	.03341	269.380
68	.04618	194.890	95	.03306	272.232
69	.04552	197.715	96	.03272	275.061
70	.04486	200.624	97	.03238	277.949
71	.04423	203.482	98	.03205	280.811
72	.04362	206.327	99	.03173	283.643
73	.04302	209.205	100	.03141	286.533

CIRCUMFERENCES AND AREAS OF CIRCLES FROM $\frac{1}{64}$ TO 100

Diameter	Cir- cumference	Area	Diameter	Cir- cumference	Area
$\frac{1}{64}$	.04909	.00019	5	15.708	19.635
$\frac{1}{32}$	.09818	.00077	$5\frac{1}{8}$	16.101	20.629
$\frac{1}{16}$	.19635	.00307	$5\frac{1}{4}$	16.493	21.648
$\frac{1}{8}$	.39270	.01227	$5\frac{1}{2}$	16.886	22.691
$\frac{3}{16}$	.58905	.02761	$5\frac{3}{4}$	17.279	23.758
$\frac{1}{4}$	.78540	.04909	$5\frac{7}{8}$	17.672	24.850
$\frac{5}{16}$	.98175	.07670	$5\frac{3}{4}$	18.064	25.967
$\frac{3}{8}$	1.1781	.11045	$5\frac{1}{2}$	18.457	27.109
$\frac{7}{16}$	1.3745	.15033			
$\frac{1}{2}$	1.5708	.19635	6	18.850	28.274
$\frac{9}{16}$	1.7672	.24850	$6\frac{1}{8}$	19.242	29.465
$\frac{5}{8}$	1.9635	.30680	$6\frac{1}{4}$	19.635	30.680
$\frac{11}{16}$	2.1598	.37122	$6\frac{3}{8}$	20.028	31.919
$\frac{3}{4}$	2.3562	.44179	$6\frac{1}{2}$	20.420	33.183
$\frac{13}{16}$	2.5525	.51849	$6\frac{5}{8}$	20.813	34.471
$\frac{7}{8}$	2.7489	.60132	$6\frac{3}{4}$	21.206	35.785
$\frac{15}{16}$	2.9452	.69029	$6\frac{7}{8}$	21.598	37.122
1	3.1416	.78540			
$1\frac{1}{8}$	3.5343	.99402	7	21.991	38.485
$1\frac{1}{4}$	3.9270	1.2272	$7\frac{1}{8}$	22.384	39.871
$1\frac{3}{8}$	4.3197	1.4849	$7\frac{1}{4}$	22.777	41.282
$1\frac{1}{2}$	4.7124	1.7671	$7\frac{3}{8}$	23.169	42.718
$1\frac{5}{8}$	5.1051	2.0739	$7\frac{1}{2}$	23.562	44.179
$1\frac{3}{4}$	5.4978	2.4053	$7\frac{5}{8}$	23.955	45.664
$1\frac{7}{8}$	5.8905	2.7612	$7\frac{3}{4}$	24.347	47.173
			$7\frac{1}{2}$	24.740	48.707
2	6.2832	3.1416			
$2\frac{1}{8}$	6.6759	3.5466	8	25.133	50.265
$2\frac{1}{4}$	7.0686	3.9761	$8\frac{1}{8}$	25.525	51.849
$2\frac{3}{8}$	7.4613	4.4301	$8\frac{1}{4}$	25.918	53.456
$2\frac{1}{2}$	7.8540	4.9087	$8\frac{3}{8}$	26.311	55.088
$2\frac{5}{8}$	8.2467	5.4119	$8\frac{1}{2}$	26.704	56.745
$2\frac{3}{4}$	8.6394	5.9396	$8\frac{5}{8}$	27.096	58.426
$2\frac{7}{8}$	9.0321	6.4918	$8\frac{3}{4}$	27.489	60.132
			$8\frac{1}{2}$	27.882	61.862
3	9.4248	7.0686			
$3\frac{1}{8}$	9.8175	7.6699	9	28.274	63.617
$3\frac{1}{4}$	10.210	8.2958	$9\frac{1}{8}$	28.667	65.397
$3\frac{3}{8}$	10.603	8.9462	$9\frac{1}{4}$	29.060	67.201
$3\frac{1}{2}$	10.996	9.6211	$9\frac{3}{8}$	29.452	69.029
$3\frac{5}{8}$	11.388	10.321	$9\frac{1}{2}$	29.845	70.882
$3\frac{3}{4}$	11.781	11.045	$9\frac{5}{8}$	30.238	72.760
$3\frac{7}{8}$	12.174	11.793	$9\frac{3}{4}$	30.631	74.662
			$9\frac{1}{2}$	31.023	76.589
4	12.566	12.566			
$4\frac{1}{8}$	12.959	13.364	10	31.416	78.540
$4\frac{1}{4}$	13.352	14.186	$10\frac{1}{8}$	31.809	80.516
$4\frac{3}{8}$	13.745	15.033	$10\frac{1}{4}$	32.201	82.516
$4\frac{1}{2}$	14.137	15.904	$10\frac{3}{8}$	32.594	84.541
$4\frac{5}{8}$	14.530	16.800	$10\frac{1}{2}$	32.987	86.590
$4\frac{3}{4}$	14.923	17.721	$10\frac{5}{8}$	33.379	88.664
$4\frac{7}{8}$	15.315	18.665	$10\frac{3}{4}$	33.772	90.763
			$10\frac{1}{2}$	34.165	92.886

CIRCUMFERENCES AND AREAS OF CIRCLES (Continued)

Diameter	Cir- cumference	Area	Diameter	Cir- cumference	Area
11	34.558	95.033	17	53.407	226.98
11 $\frac{1}{8}$	34.950	97.205	17 $\frac{1}{8}$	53.800	230.33
11 $\frac{1}{4}$	35.343	99.402	17 $\frac{1}{4}$	54.193	233.71
11 $\frac{3}{8}$	35.736	101.62	17 $\frac{3}{8}$	54.585	237.10
11 $\frac{1}{2}$	36.128	103.87	17 $\frac{1}{2}$	54.978	240.53
11 $\frac{5}{8}$	36.521	106.14	17 $\frac{5}{8}$	55.371	243.98
11 $\frac{3}{4}$	36.914	108.43	17 $\frac{3}{4}$	55.763	247.45
11 $\frac{7}{8}$	37.306	110.75	17 $\frac{7}{8}$	56.156	250.95
12	37.699	113.10	18	56.549	254.47
12 $\frac{1}{8}$	38.092	115.47	18 $\frac{1}{8}$	56.941	258.02
12 $\frac{1}{4}$	38.485	117.86	18 $\frac{1}{4}$	57.334	261.59
12 $\frac{3}{8}$	38.877	120.28	18 $\frac{3}{8}$	57.727	265.18
12 $\frac{1}{2}$	39.270	122.72	18 $\frac{1}{2}$	58.120	268.80
12 $\frac{5}{8}$	39.663	125.19	18 $\frac{5}{8}$	58.512	272.45
12 $\frac{3}{4}$	40.055	127.68	18 $\frac{3}{4}$	58.905	276.12
12 $\frac{7}{8}$	40.448	130.19	18 $\frac{7}{8}$	59.298	279.81
13	40.841	132.73	19	59.690	283.53
13 $\frac{1}{8}$	41.233	135.30	19 $\frac{1}{8}$	60.083	287.27
13 $\frac{1}{4}$	41.626	137.89	19 $\frac{1}{4}$	60.476	291.04
13 $\frac{3}{8}$	42.019	140.50	19 $\frac{3}{8}$	60.868	294.83
13 $\frac{1}{2}$	42.412	143.14	19 $\frac{1}{2}$	61.261	298.65
13 $\frac{5}{8}$	42.804	145.80	19 $\frac{5}{8}$	61.654	302.49
13 $\frac{3}{4}$	43.197	148.49	19 $\frac{3}{4}$	62.047	306.35
13 $\frac{7}{8}$	43.590	151.20	19 $\frac{7}{8}$	62.439	310.24
14	43.982	153.94	20	62.832	314.16
14 $\frac{1}{8}$	44.375	156.70	20 $\frac{1}{8}$	63.225	318.10
14 $\frac{1}{4}$	44.768	159.48	20 $\frac{1}{4}$	63.617	322.06
14 $\frac{3}{8}$	45.160	162.30	20 $\frac{3}{8}$	64.010	326.05
14 $\frac{1}{2}$	45.553	165.13	20 $\frac{1}{2}$	64.403	330.06
14 $\frac{5}{8}$	45.946	167.99	20 $\frac{5}{8}$	64.795	334.10
14 $\frac{3}{4}$	46.339	170.87	20 $\frac{3}{4}$	65.188	338.16
14 $\frac{7}{8}$	46.731	173.78	20 $\frac{7}{8}$	65.581	342.25
15	47.124	176.71	21	65.973	346.36
15 $\frac{1}{8}$	47.517	179.67	21 $\frac{1}{8}$	66.366	350.50
15 $\frac{1}{4}$	47.909	182.65	21 $\frac{1}{4}$	66.759	354.66
15 $\frac{3}{8}$	48.302	185.66	21 $\frac{3}{8}$	67.152	358.84
15 $\frac{1}{2}$	48.695	188.69	21 $\frac{1}{2}$	67.544	363.05
15 $\frac{5}{8}$	49.087	191.75	21 $\frac{5}{8}$	67.937	367.28
15 $\frac{3}{4}$	49.480	194.83	21 $\frac{3}{4}$	68.330	371.54
15 $\frac{7}{8}$	49.873	197.93	21 $\frac{7}{8}$	68.722	375.83
16	50.266	201.06	22	69.115	380.13
16 $\frac{1}{8}$	50.658	204.22	22 $\frac{1}{8}$	69.508	384.46
16 $\frac{1}{4}$	51.051	207.39	22 $\frac{1}{4}$	69.900	388.82
16 $\frac{3}{8}$	51.444	210.60	22 $\frac{3}{8}$	70.293	393.20
16 $\frac{1}{2}$	51.836	213.82	22 $\frac{1}{2}$	70.686	397.61
16 $\frac{5}{8}$	52.229	217.08	22 $\frac{5}{8}$	71.079	402.04
16 $\frac{3}{4}$	52.622	220.35	22 $\frac{3}{4}$	71.471	406.49
16 $\frac{7}{8}$	53.014	223.65	22 $\frac{7}{8}$	71.864	410.97

CIRCUMFERENCES AND AREAS OF CIRCLES (Continued)

Diameter	Cir- cumference	Area	Diameter	Cir- cumference	Area
23	72.257	415.48	29	91.106	660.52
23 $\frac{1}{8}$	72.649	420.00	29 $\frac{1}{8}$	91.499	666.23
23 $\frac{1}{4}$	73.042	424.56	29 $\frac{1}{4}$	91.892	671.96
23 $\frac{3}{8}$	73.435	429.13	29 $\frac{3}{8}$	92.284	677.71
23 $\frac{1}{2}$	73.827	433.74	29 $\frac{1}{2}$	92.677	683.49
23 $\frac{5}{8}$	74.220	438.36	29 $\frac{5}{8}$	93.070	689.30
23 $\frac{3}{4}$	74.613	443.01	29 $\frac{3}{4}$	93.462	695.13
23 $\frac{7}{8}$	75.006	447.69	29 $\frac{7}{8}$	93.855	700.98
24	75.398	452.39	30	94.248	706.86
24 $\frac{1}{8}$	75.791	457.11	30 $\frac{1}{8}$	94.641	712.76
24 $\frac{1}{4}$	76.184	461.86	30 $\frac{1}{4}$	95.033	718.69
24 $\frac{3}{8}$	76.578	466.64	30 $\frac{3}{8}$	95.426	724.64
24 $\frac{1}{2}$	76.969	471.44	30 $\frac{1}{2}$	95.819	730.62
24 $\frac{3}{4}$	77.362	476.26	30 $\frac{3}{4}$	96.211	736.62
24 $\frac{7}{8}$	77.754	481.11	30 $\frac{7}{8}$	96.604	742.64
	78.147	485.98		96.997	748.69
25	78.540	490.87	31	97.389	754.77
25 $\frac{1}{8}$	78.933	495.79	31 $\frac{1}{8}$	97.782	760.87
25 $\frac{1}{4}$	79.325	500.74	31 $\frac{1}{4}$	98.175	766.99
25 $\frac{3}{8}$	79.718	505.71	31 $\frac{3}{8}$	98.568	773.14
25 $\frac{1}{2}$	80.111	510.71	31 $\frac{1}{2}$	98.960	779.31
25 $\frac{5}{8}$	80.503	515.72	31 $\frac{5}{8}$	99.353	785.51
25 $\frac{3}{4}$	80.896	520.77	31 $\frac{3}{4}$	99.746	791.73
25 $\frac{7}{8}$	81.289	525.84	31 $\frac{7}{8}$	100.14	797.98
26	81.681	530.93	32	100.53	804.25
26 $\frac{1}{8}$	82.074	536.05	32 $\frac{1}{8}$	100.92	810.54
26 $\frac{1}{4}$	82.467	541.19	32 $\frac{1}{4}$	101.32	816.86
26 $\frac{3}{8}$	82.860	546.35	32 $\frac{3}{8}$	101.71	823.21
26 $\frac{1}{2}$	83.252	551.55	32 $\frac{1}{2}$	102.10	829.58
26 $\frac{5}{8}$	83.645	556.76	32 $\frac{5}{8}$	102.49	835.97
26 $\frac{3}{4}$	84.038	562.00	32 $\frac{3}{4}$	102.89	842.39
26 $\frac{7}{8}$	84.430	567.27	32 $\frac{7}{8}$	103.28	848.83
27	84.823	572.56	33	103.67	855.30
27 $\frac{1}{8}$	85.216	577.87	33 $\frac{1}{8}$	104.07	861.79
27 $\frac{1}{4}$	85.608	583.21	33 $\frac{1}{4}$	104.46	868.31
27 $\frac{3}{8}$	86.001	588.57	33 $\frac{3}{8}$	104.85	874.85
27 $\frac{1}{2}$	86.394	593.96	33 $\frac{1}{2}$	105.24	881.41
27 $\frac{5}{8}$	86.787	599.37	33 $\frac{5}{8}$	105.64	888.00
27 $\frac{3}{4}$	87.179	604.81	33 $\frac{3}{4}$	106.03	894.62
27 $\frac{7}{8}$	87.572	610.27	33 $\frac{7}{8}$	106.42	901.26
28	87.965	615.75	34	106.81	907.92
28 $\frac{1}{8}$	88.357	621.26	34 $\frac{1}{8}$	107.21	914.61
28 $\frac{1}{4}$	88.750	626.80	34 $\frac{1}{4}$	107.60	921.32
28 $\frac{3}{8}$	89.143	632.36	34 $\frac{3}{8}$	107.99	928.06
28 $\frac{1}{2}$	89.535	637.94	34 $\frac{1}{2}$	108.39	934.82
28 $\frac{5}{8}$	89.928	643.55	34 $\frac{5}{8}$	108.78	941.61
28 $\frac{3}{4}$	90.321	649.18	34 $\frac{3}{4}$	109.17	948.42
28 $\frac{7}{8}$	90.714	654.84	34 $\frac{7}{8}$	109.56	955.25

CIRCUMFERENCES AND AREAS OF CIRCLES (Continued)

Diameter	Cir- cumference	Area	Diameter	Cir- cumference	Area
35	109.96	962.11	41	128.81	1320.3
35 $\frac{1}{8}$	110.35	969.00	41 $\frac{1}{8}$	129.20	1328.3
35 $\frac{1}{4}$	110.74	975.91	41 $\frac{1}{4}$	129.59	1336.4
35 $\frac{3}{8}$	111.13	982.84	41 $\frac{3}{8}$	129.98	1344.5
35 $\frac{1}{2}$	111.53	989.80	41 $\frac{1}{2}$	130.38	1352.7
35 $\frac{5}{8}$	111.92	996.78	41 $\frac{5}{8}$	130.77	1360.8
35 $\frac{3}{4}$	112.31	1003.8	41 $\frac{3}{4}$	131.16	1369.0
35 $\frac{7}{8}$	112.71	1010.8	41 $\frac{7}{8}$	131.55	1377.2
36	113.10	1017.9	42	131.95	1385.4
36 $\frac{1}{8}$	113.49	1025.0	42 $\frac{1}{8}$	132.34	1393.7
36 $\frac{1}{4}$	113.88	1032.1	42 $\frac{1}{4}$	132.73	1402.0
36 $\frac{3}{8}$	114.28	1039.2	42 $\frac{3}{8}$	133.13	1410.3
36 $\frac{1}{2}$	114.67	1046.3	42 $\frac{1}{2}$	133.52	1418.6
36 $\frac{5}{8}$	115.06	1053.5	42 $\frac{5}{8}$	133.91	1427.0
36 $\frac{3}{4}$	115.45	1060.7	42 $\frac{3}{4}$	134.30	1435.4
36 $\frac{7}{8}$	115.85	1068.0	42 $\frac{7}{8}$	134.70	1443.8
37	116.24	1075.2	43	135.09	1452.2
37 $\frac{1}{8}$	116.63	1082.5	43 $\frac{1}{8}$	135.48	1460.7
37 $\frac{1}{4}$	117.02	1089.8	43 $\frac{1}{4}$	135.87	1469.1
37 $\frac{3}{8}$	117.42	1097.1	43 $\frac{3}{8}$	136.27	1477.6
37 $\frac{1}{2}$	117.81	1104.5	43 $\frac{1}{2}$	136.66	1486.2
37 $\frac{5}{8}$	118.20	1111.8	43 $\frac{5}{8}$	137.05	1494.7
37 $\frac{3}{4}$	118.60	1119.2	43 $\frac{3}{4}$	137.45	1503.3
37 $\frac{7}{8}$	118.99	1126.7	43 $\frac{7}{8}$	137.84	1511.9
38	119.38	1134.1	44	138.23	1520.5
38 $\frac{1}{8}$	119.77	1141.6	44 $\frac{1}{8}$	138.62	1529.2
38 $\frac{1}{4}$	120.17	1149.1	44 $\frac{1}{4}$	139.02	1537.9
38 $\frac{3}{8}$	120.56	1156.6	44 $\frac{3}{8}$	139.41	1546.6
38 $\frac{1}{2}$	120.95	1164.2	44 $\frac{1}{2}$	139.80	1555.3
38 $\frac{5}{8}$	121.34	1171.7	44 $\frac{5}{8}$	140.19	1564.0
38 $\frac{3}{4}$	121.74	1179.3	44 $\frac{3}{4}$	140.59	1572.8
38 $\frac{7}{8}$	122.13	1186.9	44 $\frac{7}{8}$	140.98	1581.6
39	122.52	1194.6	45	141.37	1590.4
39 $\frac{1}{8}$	122.92	1202.3	45 $\frac{1}{8}$	141.76	1599.3
39 $\frac{1}{4}$	123.31	1210.0	45 $\frac{1}{4}$	142.16	1608.2
39 $\frac{3}{8}$	123.70	1217.7	45 $\frac{3}{8}$	142.55	1617.0
39 $\frac{1}{2}$	124.09	1225.4	45 $\frac{1}{2}$	142.94	1626.0
39 $\frac{5}{8}$	124.49	1233.2	45 $\frac{5}{8}$	143.34	1634.9
39 $\frac{3}{4}$	124.88	1241.0	45 $\frac{3}{4}$	143.73	1643.9
39 $\frac{7}{8}$	125.27	1248.8	45 $\frac{7}{8}$	144.12	1652.9
40	125.66	1256.6	46	144.51	1661.9
40 $\frac{1}{8}$	126.06	1264.5	46 $\frac{1}{8}$	144.91	1670.9
40 $\frac{1}{4}$	126.45	1272.4	46 $\frac{1}{4}$	145.30	1680.0
40 $\frac{3}{8}$	126.84	1280.3	46 $\frac{3}{8}$	145.69	1689.1
40 $\frac{1}{2}$	127.24	1288.2	46 $\frac{1}{2}$	146.08	1698.2
40 $\frac{5}{8}$	127.63	1296.2	46 $\frac{5}{8}$	146.48	1707.4
40 $\frac{3}{4}$	128.02	1304.2	46 $\frac{3}{4}$	146.87	1716.5
40 $\frac{7}{8}$	128.41	1312.2	46 $\frac{7}{8}$	147.26	1725.7

CIRCUMFERENCES AND AREAS OF CIRCLES (Concluded)

Diameter	Cir- cumference	Area	Diameter	Cir- cumference	Area
47	147.66	1734.9	61	191.64	2922.5
47 $\frac{1}{8}$	148.05	1744.2	62	194.78	3019.1
47 $\frac{1}{4}$	148.44	1753.5	63	197.92	3117.2
47 $\frac{3}{8}$	148.83	1762.7	64	201.06	3217.0
47 $\frac{1}{2}$	149.23	1772.1	65	204.20	3318.3
47 $\frac{5}{8}$	149.62	1781.4	66	207.35	3421.2
47 $\frac{3}{4}$	150.01	1790.8	67	210.49	3525.7
47 $\frac{7}{8}$	150.40	1800.1	68	213.63	3631.7
			69	216.77	3739.3
			70	219.91	3848.5
48	150.80	1809.6			
48 $\frac{1}{8}$	151.19	1819.0	71	223.05	3959.2
48 $\frac{1}{4}$	151.58	1828.5	72	226.20	4071.5
48 $\frac{3}{8}$	151.98	1837.9	73	229.34	4185.4
48 $\frac{1}{2}$	152.37	1847.5	74	232.48	4300.8
48 $\frac{5}{8}$	152.76	1857.0	75	235.62	4417.9
48 $\frac{3}{4}$	153.15	1866.5	76	238.76	4536.5
48 $\frac{7}{8}$	153.55	1876.1	77	241.90	4656.6
			78	245.04	4778.4
			79	248.19	4901.7
49	153.94	1885.7	80	251.33	5026.5
49 $\frac{1}{8}$	154.33	1895.4			
49 $\frac{1}{4}$	154.72	1905.0	81	254.47	5153.0
49 $\frac{3}{8}$	155.12	1914.7	82	257.61	5281.0
49 $\frac{1}{2}$	155.51	1924.4	83	260.75	5410.6
49 $\frac{5}{8}$	155.90	1934.2	84	263.89	5541.8
49 $\frac{3}{4}$	156.29	1943.9	85	267.04	5674.5
49 $\frac{7}{8}$	156.69	1953.7	86	270.18	5808.8
			87	273.32	5944.7
			88	276.46	6082.1
50	157.08	1963.5	89	279.60	6221.1
			90	282.74	6361.7
51	160.22	2042.8	91	285.89	6503.9
52	163.36	2123.7	92	289.03	6647.6
53	166.50	2206.2	93	292.17	6792.9
54	169.65	2290.2	94	295.31	6939.8
55	172.79	2375.8	95	298.45	7088.2
56	175.93	2463.0	96	301.59	7238.2
57	179.07	2551.8	97	304.73	7389.8
58	182.21	2642.1	98	307.88	7543.0
59	185.35	2734.0	99	311.02	7697.7
60	188.50	2827.4	100	314.16	7854.0

MELTING POINTS

Metals and Alloys	Degrees Centigrade	Degrees Fahrenheit
Aluminum.....	658.9	1218.
Bronze (about).....	1050.	1920.
Brass (about).....	940.	1720.
Cast iron, gray.....	1230.	2250.
Cast iron, white.....	1150.	2100.
Copper.....	1083.1	1981.6
Gold.....	1062.6	1944.7
Iron, wrought.....	1510.	2750.
Lead.....	327.4	621.3
Nickel.....	1452.	2646.
Platinum.....	1755.	3191.
Silver.....	960.5	1760.9
Tin.....	231.9	449.3
Zinc.....	419.5	787.1
Minerals and Oxides	Degrees Centigrade	Degrees Fahrenheit
Alumina (Al_2O_3).....	2050	3722
Chromite (FeOCr_2O_3).....	2180	3956
Forsterite.....	1910	3470
Lime (CaO).....	2570	4658
Magnesia (MgO).....	2800	5072
Silica (cristobalite).....	1713	3115

Kaolinite ($\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$) has a P.C.E. value of cone 35 corresponding to 1785°C. (3245°F.).

Mullite ($3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$) melts incongruently at 1810°C. (3290°F.) to form corundum and a silicious liquid. It is completely melted at 1920°C. (3488°F.).

FURNACE TEMPERATURES

	Degrees Centigrade	Degrees Fahrenheit
AIR FURNACE—		
(Malleable Iron)		
Melting chamber (maximum)	1650	3000
Base of stack, up to.....	1315	2400
BLAST FURNACE—		
Gray Bessemer		
Front of tuyere.....	1705	3100
Iron at tapping.....	1510	2750
BESSEMER CONVERTER		
Running steel into ladle.....	1640	2980
Running steel into mold.....	1580	2875
Soaking pit furnace, ingot in.	1200	2190
GAS PRODUCER		
Combustion zone.....	1370	2500
Gas leaving producer.....	680	1250
GLASS FURNACE		
Plate glass between pots....	1375	2510
Plate glass in pots, refining..	1310	2390
Plate glass in pots, working	1050	1920
Tanks melted for casting....	1325	2420
Annealing glassware.....	440 to 550	800 to 1000
OPEN HEARTH FURNACE		
Gas entering regenerator....	590	1100
Gas leaving regenerator.....	1200	2190
Air leaving regenerator.....	1100	2010
Waste gases entering stack..	650	1200
Refining the steel.....	1650	3000
Running into ladle.....	1580	2875

COLOR SCALE FOR TEMPERATURES

Color	Degrees Centigrade	Degrees Fahrenheit
Lowest visible red.....	475	875
Lowest visible red to dark red.....	475 to 650	875 to 1200
Dark red to cherry red....	650 to 750	1200 to 1375
Cherry red to bright cherry red....	750 to 825	1375 to 1500
Bright cherry red to orange.....	825 to 900	1500 to 1650
Orange to yellow.....	900 to 1090	1650 to 2000
Yellow to light yellow....	1090 to 1320	2000 to 2400
Light yellow to white....	1320 to 1540	2400 to 2800
White to dazzling white..	1540 and over	2800 and over

TEMPERATURE END POINTS OF PYROMETRIC CONES

DEFINITION: Pyrometric Cone Equivalent (P. C. E.)—In the case of refractories, the number of that standard cone whose tip would touch the supporting plaque simultaneously with a cone of the material being investigated when tested in accordance with the Standard Method of Test for P. C. E. of Fireclay Brick (A. S. T. M. Designation C-24) of the American Society for Testing Materials.

NOTE: The terms—"fusion point," "softening point," "deformation point," and "melting point" have heretofore been loosely used for "pyrometric cone equivalent."

No. of Cone	End point*		No. of Cone	End point*	
	Degrees Cent.	Degrees Fahr.		Degrees Cent.	Degrees Fahr.
022	605	1121	7	1250	2282
021	615	1139	8	1260	2300
020	650	1202	9	1285	2345
019	660	1220	10	1305	2381
018	720	1328	11	1325	2417
017	770	1418	12	1335	2435
016	795	1463	13	1350	2462
015	805	1481	14	1400	2552
014	830	1526	15	1435	2615
013	860	1580	16	1465	2669
012	875	1607	17	1475	2687
011	905	1661	18	1490	2714
010	895	1643	19	1520	2768
09	930	1706	20	1530	2786
08	950	1742	23	1580	2876
07	990	1814	26	1595	2903
06	1015	1859	27	1605	2921
05	1040	1904	28	1615	2939
04	1060	1940	29	1640	2984
03	1115	2039	30	1650	3002
02	1125	2057	31	1680	3056
01	1145	2093	32	1700	3092
1	1160	2120	†32½	1722	3131
2	1165	2129	33	1745	3173
3	1170	2138	34	1760	3200
4	1190	2174	35	1785	3245
5	1205	2201	36	1810	3290
6	1230	2246	37	1820	3308
			38	1835	3335

*NOTE: Pyrometric cones do not give an accurate measurement of temperature. Where it is desired to interpret P. C. E. values approximately in terms of temperature, the table above may be used. This table has been approved by the A. S. T. M. It is based on the work of Fairchild and Peters. J. Amer. Cer. Soc. 9, 701-43, 1926. Heating rate 150° Cent. per hour for cones .022 to 20, inclusive, and 100° Cent. per hour for cones 23 to 38, inclusive. The temperatures do not apply to the slower rates of heating common in the commercial firing and the use of refractory materials.

†Not included in the tests of Fairchild and Peters. The temperatures given are approximate.

TEMPERATURE CONVERSION TABLES

By Albert Sauveur

0 to 100

C.		F.	C.		F.
-17.8	0	32	10.0	50	122.0
-17.2	1	33.8	10.6	51	123.8
-16.7	2	35.6	11.1	52	125.6
-16.1	3	37.4	11.7	53	127.4
-15.6	4	39.2	12.2	54	129.2
-15.0	5	41.0	12.8	55	131.0
-14.4	6	42.8	13.3	56	132.8
-13.9	7	44.6	13.9	57	134.6
-13.3	8	46.4	14.4	58	136.4
-12.8	9	48.2	15.0	59	138.2
-12.2	10	50.0	15.6	60	140.0
-11.7	11	51.8	16.1	61	141.8
-11.1	12	53.6	16.7	62	143.6
-10.6	13	55.4	17.2	63	145.4
-10.0	14	57.2	17.8	64	147.2
-9.44	15	59.0	18.3	65	149.0
-8.89	16	60.8	18.9	66	150.8
-8.33	17	62.6	19.4	67	152.6
-7.78	18	64.4	20.0	68	154.4
-7.22	19	66.2	20.6	69	156.2
-6.67	20	68.0	21.1	70	158.0
-6.11	21	69.8	21.7	71	159.8
-5.56	22	71.6	22.2	72	161.6
-5.00	23	73.4	22.8	73	163.4
-4.44	24	75.2	23.3	74	165.2
-3.89	25	77.0	23.9	75	167.0
-3.33	26	78.8	24.4	76	168.8
-2.78	27	80.6	25.0	77	170.6
-2.22	28	82.4	25.6	78	172.4
-1.67	29	84.2	26.1	79	174.2
-1.11	30	86.0	26.7	80	176.0
-0.56	31	87.8	27.2	81	177.8
0	32	89.6	27.8	82	179.6
0.56	33	91.4	28.3	83	181.4
1.11	34	93.2	28.9	84	183.2
1.67	35	95.0	29.4	85	185.0
2.22	36	96.8	30.0	86	186.8
2.78	37	98.6	30.6	87	188.6
3.33	38	100.4	31.1	88	190.4
3.89	39	102.2	31.7	89	192.2
4.44	40	104.0	32.2	90	194.0
5.00	41	105.8	32.8	91	195.8
5.56	42	107.6	33.3	92	197.6
6.11	43	109.4	33.9	93	199.4
6.67	44	111.2	34.4	94	201.2
7.22	45	113.0	35.0	95	203.0
7.78	46	114.8	35.6	96	204.8
8.33	47	116.6	36.1	97	206.6
8.89	48	118.4	36.7	98	208.4
9.44	49	120.2	37.2	99	210.2
			37.8	100	212.0

INTERPOLATION FACTORS

C.		F.	C.		F.
0.56	1	1.8	3.33	6	10.8
1.11	2	3.6	3.89	7	12.6
1.67	3	5.4	4.44	8	14.4
2.22	4	7.2	5.00	9	16.2
2.78	5	9.0	5.56	10	18.0

Note: The numbers in bold face type refer to the temperature either in degrees Centigrade or Fahrenheit which it is desired to convert into the other scale.

TEMPERATURE CONVERSION TABLES

(Continued)

100 to 1000

C.		F.	C.		F.
38	100	212	260	500	932
43	110	230	266	510	950
49	120	248	271	520	968
54	130	266	277	530	986
60	140	284	282	540	1004
66	150	302	288	550	1022
71	160	320	293	560	1040
77	170	338	299	570	1058
82	180	356	304	580	1076
88	190	374	310	590	1094
93	200	392	316	600	1112
99	210	410	321	610	1130
100	212	413	327	620	1148
104	220	428	332	630	1166
110	230	446	338	640	1184
116	240	464	343	650	1202
121	250	482	349	660	1220
127	260	500	354	670	1238
132	270	518	360	680	1256
138	280	536	366	690	1274
143	290	554	371	700	1292
149	300	572	377	710	1310
154	310	590	382	720	1328
160	320	608	388	730	1346
166	330	626	393	740	1364
171	340	644	399	750	1382
177	350	662	404	760	1400
182	360	680	410	770	1418
188	370	698	416	780	1436
193	380	716	421	790	1454
199	390	734	427	800	1472
204	400	752	432	810	1490
210	410	770	438	820	1508
216	420	788	443	830	1526
221	430	806	449	840	1544
227	440	824	454	850	1562
232	450	842	460	860	1580
238	460	860	466	870	1598
243	470	878	471	880	1616
249	480	896	477	890	1634
254	490	914	482	900	1652
			488	910	1670
			493	920	1688
			499	930	1706
			504	940	1724
			510	950	1742
			516	960	1760
			521	970	1778
			527	980	1796
			532	990	1814
			538	1000	1832

INTERPOLATION FACTORS

C.		F.	C.		F.
0.56	1	1.8	3.33	6	10.8
1.11	2	3.6	3.89	7	12.6
1.67	3	5.4	4.44	8	14.4
2.22	4	7.2	5.00	9	16.2
2.78	5	9.0	5.56	10	18.0

Note: The numbers in bold face type refer to the temperature either in degrees Centigrade or Fahrenheit which it is desired to convert into the other scale.

TEMPERATURE CONVERSION TABLES

(Continued)

1000 to 2000

C.		F.	C.		F.
538	1000	1832	816	1500	2732
543	1010	1850	821	1510	2750
549	1020	1868	827	1520	2768
554	1030	1886	832	1530	2786
560	1040	1904	838	1540	2804
566	1050	1922	843	1550	2822
571	1060	1940	849	1560	2840
577	1070	1958	854	1570	2858
582	1080	1976	860	1580	2876
588	1090	1994	866	1590	2894
593	1100	2012	871	1600	2912
599	1110	2030	877	1610	2930
604	1120	2048	882	1620	2948
610	1130	2066	888	1630	2966
616	1140	2084	893	1640	2984
621	1150	2102	899	1650	3002
627	1160	2120	904	1660	3020
632	1170	2138	910	1670	3038
638	1180	2156	916	1680	3056
643	1190	2174	921	1690	3074
649	1200	2192	927	1700	3092
654	1210	2210	932	1710	3110
660	1220	2228	938	1720	3128
666	1230	2246	943	1730	3146
671	1240	2264	949	1740	3164
677	1250	2282	954	1750	3182
682	1260	2300	960	1760	3200
688	1270	2318	966	1770	3218
693	1280	2336	971	1780	3236
699	1290	2354	977	1790	3254
704	1300	2372	982	1800	3272
710	1310	2390	988	1810	3290
716	1320	2408	993	1820	3308
721	1330	2426	999	1830	3326
727	1340	2444	1004	1840	3344
732	1350	2462	1010	1850	3362
738	1360	2480	1016	1860	3380
743	1370	2498	1021	1870	3398
749	1380	2516	1027	1880	3416
754	1390	2534	1032	1890	3434
760	1400	2552	1038	1900	3452
766	1410	2570	1043	1910	3470
771	1420	2588	1049	1920	3488
777	1430	2606	1054	1930	3506
782	1440	2624	1060	1940	3524
788	1450	2642	1066	1950	3542
793	1460	2660	1071	1960	3560
799	1470	2678	1077	1970	3578
804	1480	2696	1082	1980	3596
810	1490	2714	1088	1990	3614
			1093	2000	3632

INTERPOLATION FACTORS

C.		F.	C.		F.
0.56	1	1.8	3.33	6	10.8
1.11	2	3.6	3.89	7	12.6
1.67	3	5.4	4.44	8	14.4
2.22	4	7.2	5.00	9	16.2
2.78	5	9.0	5.56	10	18.0

Note: The numbers in bold face type refer to the temperature either in degrees Centigrade or Fahrenheit which it is desired to convert into the other scale.

TEMPERATURE CONVERSION TABLES

(Concluded)

2000 to 3000

C.		F.	C.		F.
I093	2000	3632	I371	2500	4532
I099	2010	3650	I377	2510	4550
I104	2020	3668	I382	2520	4568
I110	2030	3686	I388	2530	4586
I116	2040	3704	I393	2540	4604
I121	2050	3722	I399	2550	4622
I127	2060	3740	I404	2560	4640
I132	2070	3758	I410	2570	4658
I138	2080	3776	I416	2580	4676
I143	2090	3794	I421	2590	4694
I149	2100	3812	I427	2600	4712
I154	2110	3830	I432	2610	4730
I160	2120	3848	I438	2620	4748
I166	2130	3866	I443	2630	4766
I171	2140	3884	I449	2640	4784
I177	2150	3902	I454	2650	4802
I182	2160	3920	I460	2660	4820
I188	2170	3938	I466	2670	4838
I193	2180	3956	I471	2680	4856
I199	2190	3974	I477	2690	4874
I204	2200	3992	I482	2700	4892
I210	2210	4010	I488	2710	4910
I216	2220	4028	I493	2720	4928
I221	2230	4046	I499	2730	4946
I227	2240	4064	I504	2740	4964
I232	2250	4082	I510	2750	4982
I238	2260	4100	I516	2760	5000
I243	2270	4118	I521	2770	5018
I249	2280	4136	I527	2780	5036
I254	2290	4154	I532	2790	5054
I260	2300	4172	I538	2800	5072
I266	2310	4190	I543	2810	5090
I271	2320	4208	I549	2820	5108
I277	2330	4226	I554	2830	5126
I282	2340	4244	I560	2840	5144
I288	2350	4262	I566	2850	5162
I293	2360	4280	I571	2860	5180
I299	2370	4298	I577	2870	5198
I304	2380	4316	I582	2880	5216
I310	2390	4334	I588	2890	5234
I316	2400	4352	I593	2900	5252
I321	2410	4370	I599	2910	5270
I327	2420	4388	I604	2920	5288
I332	2430	4406	I610	2930	5306
I338	2440	4424	I616	2940	5324
I343	2450	4442	I621	2950	5342
I349	2460	4460	I627	2960	5360
I354	2470	4478	I632	2970	5378
I360	2480	4496	I638	2980	5396
I366	2490	4514	I643	2990	5414
			I649	3000	5432

INTERPOLATION FACTORS

C.		F.	C.		F.
0.56	1	1.8	3.33	6	10.8
1.11	2	3.6	3.89	7	12.6
1.67	3	5.4	4.44	8	14.4
2.22	4	7.2	5.00	9	16.2
2.78	5	9.0	5.56	10	18.0

Note: The numbers in bold face type refer to the temperature either in degrees Centigrade or Fahrenheit which it is desired to convert into the other scale.

WEIGHTS OF VARIOUS MATERIALS

Material	Average per cubic foot in pounds	Material	Average per cubic foot in pounds
BRICK		METALS—Continued	
Common.....	100	Copper, rolled or wire.....	555
Fireclay.....	120 to 140	Iron, cast.....	450
Silica.....	105	Iron, wrought.....	482
Chrome.....	175	Lead, cast.....	708
Magnesia as brick or fused in furnace.....	170	Lead, rolled.....	711
CEMENTS		Steel, cast.....	490
Portland.....	78	Steel, rolled.....	495
Hydraulic.....	60	Tin, cast.....	459
FINE GROUND CLAYS,		Zinc, cast.....	438
SILICA CEMENT, ETC.		OILS	
Fire clay.....	85	Engine.....	55
Silica cement.....	75	Crude.....	48
Magnesia cement.....	127	Petroleum.....	55
Chrome cement.....	135	Gasoline.....	43
Grain magnesite (as shipped).....	112	ROCKS	
COAL AND COKE		Chalk.....	145
Anthracite.....	60	Granite.....	165
Bituminous.....	49	Gypsum.....	143
Charcoal.....	18.5	Sandstone.....	144
Coke.....	26.3	Pumice stone.....	57
CONCRETE		Quartz.....	165
Cement, fine.....	137	Salt, coarse.....	45
Rubble, coarse.....	119	Salt, fine.....	49
EARTH		Shales.....	162
Loam, dry, loose.....	76	Slate, American.....	175
Loam, packed.....	95	SAND	
Loam, soft, loose mud.....	108	Dry and loose.....	100
Loam, dense mud.....	125	Dry and packed.....	110
GLASS		Wet and packed.....	130
Common window.....	157	Gravel packed.....	118
Plate.....	172	WATER	
Flint.....	192	Water as ice.....	58.7
Floor or skylight.....	158	Water at 32 degrees Fahrenheit.....	62.4
GRAINS		Water at 212 degrees Fahrenheit.....	59.6
Corn.....	45	WOODS, DRY	
Oats.....	24	Apple.....	48
Wheat.....	48	Beech.....	43
LIME		Birch.....	45
Quick, loose lumps.....	53	Cedar, American.....	35
Quick, fine.....	75	Chestnut.....	41
Stone, large rocks.....	168	Ebony.....	76
Stone, irregular lumps.....	96	Elm.....	35
MASONRY		Hemlock.....	25
Granite or limestone.....	165	Hickory.....	53
Mortar, rubble.....	154	Ironwood.....	114
Dry.....	138	Mahogany.....	35 to 53
Sandstone, dressed.....	144	Maple.....	49
METALS		Oak, live.....	59
Aluminum.....	166	Oak, white.....	50
Brass, cast.....	524	Pine, white.....	25
Bronze.....	534	Pine, yellow northern.....	34
Copper, cast.....	537	Pine, yellow southern.....	45
		Spruce.....	25
		Black Walnut.....	35

CONVERSION TABLES

LENGTHS

1 millimeter (.001 meter)	.039370	inch
1 centimeter (.01 meter)	.39370	inch
1 meter.....	39.370	inches
1 meter.....	3.2809	feet
1 kilometer (1000 meter)	3280.9	feet
1 inch.....	25.400	millimeters
1 inch.....	2.5400	centimeters
1 foot.....	30.479	centimeters
1 foot.....	.30479	meter

AREAS

1 square millimeter.....	.0015501	square inch
1 square centimeter.....	.15501	square inch
1 square meter or centare	10.764	square feet
1 square inch.....	645.16	square millimeters
1 square inch.....	6.4514	square centimeters
1 square foot.....	929.00	square centimeters
1 square foot.....	.092900	square meter

VOLUMES

1 cubic centimeter (c.c.)	.06103	cubic inch
1 cubic meter.....	35.317	cubic feet
1 cubic inch.....	16.386	cubic centimeters
1 cubic foot.....	28317.	cubic centimeters
1 cubic foot.....	.028317	cubic meter

CAPACITIES

1 liter (1000 c.c.).....	61.025	cubic inches
1 liter.....	.035315	cubic foot
1 liter.....	1.0567	U. S. liquid quart
1 liter.....	.26418	U. S. gallon
1 cubic foot.....	28.317	liters
1 U. S. liquid quart.....	.94633	liter
1 U. S. gallon.....	3.7853	liters
1 cubic foot.....	7.4805	U. S. gallons
1 U. S. liquid quart.....	57.750	cubic inches
1 U. S. gallon.....	231.00	cubic inches
1 U. S. gallon.....	.13368	cubic foot

WEIGHTS

1 gram.....	15.432	grains
1 gram.....	.035274	oz. avoirdupois
1 kilogram.....	2.2046	lb. avoirdupois
1 metric ton or 1000 kilograms.....	2204.6	lb. avoirdupois
1 grain.....	64.799	milligrams
1 ounce avoirdupois.....	28.350	grams
1 pound avoirdupois.....	453.59	grams
1 pound avoirdupois.....	.45359	kilogram

DECIMALS OF AN INCH FOR EACH $\frac{1}{64}$

Common fraction	Decimal	Common fraction	Decimal
$\frac{1}{64}$	.015625	$\frac{33}{64}$	.515625
$\frac{1}{32}$	.03125	$\frac{17}{32}$	.53125
$\frac{3}{64}$	.046875	$\frac{35}{64}$	.546875
$\frac{1}{16}$	.0625	$\frac{9}{16}$	.5625
$\frac{5}{64}$	.078125	$\frac{37}{64}$	.578125
$\frac{3}{32}$	.09375	$\frac{19}{32}$	.59375
$\frac{7}{64}$	.109375	$\frac{39}{64}$	.609375
$\frac{1}{8}$	.125	$\frac{5}{8}$	.625
$\frac{9}{64}$	.140625	$\frac{41}{64}$	.640625
$\frac{5}{32}$	.15625	$\frac{21}{32}$	.65625
$\frac{11}{64}$	.171875	$\frac{43}{64}$	.671875
$\frac{3}{16}$	.1875	$\frac{11}{16}$	.6875
$\frac{13}{64}$	.203125	$\frac{45}{64}$	.703125
$\frac{7}{32}$	.21875	$\frac{23}{32}$	.71875
$\frac{15}{64}$	.234375	$\frac{47}{64}$	.734375
$\frac{1}{4}$	.25	$\frac{3}{4}$	.75
$\frac{17}{64}$	.265625	$\frac{49}{64}$	.765625
$\frac{9}{32}$	.28125	$\frac{25}{32}$	.78125
$\frac{19}{64}$	.296875	$\frac{51}{64}$	.796875
$\frac{5}{16}$	.3125	$\frac{13}{16}$	.8125
$\frac{21}{64}$	.328125	$\frac{53}{64}$	.828125
$\frac{11}{32}$	.34375	$\frac{27}{32}$	.84375
$\frac{23}{64}$	.359375	$\frac{55}{64}$	.859375
$\frac{3}{8}$	.375	$\frac{7}{8}$	.875
$\frac{25}{64}$	.390625	$\frac{57}{64}$	.890625
$\frac{13}{32}$	.40625	$\frac{29}{32}$	.90625
$\frac{27}{64}$	.421875	$\frac{59}{64}$	.921875
$\frac{7}{16}$	.4375	$\frac{15}{16}$	.9375
$\frac{29}{64}$	.453125	$\frac{61}{64}$	.953125
$\frac{15}{32}$	.46875	$\frac{31}{32}$	.96875
$\frac{31}{64}$	.484375	$\frac{63}{64}$	.984375
$\frac{1}{2}$	.5	1	1.

